Unconsolidated Aquifer Systems of Pike County, Indiana

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Six unconsolidated aquifer systems are mapped in Pike County: the Dissected Till and Residuum; the Alluvial, Lacustrine, and Backwater Deposits; the White River and Tributaries Outwash; the White River and Tributaries Outwash Subsystem; the Buried Valley; and the Coal Mine Spoil. The first five aquifer systems comprise sediments that were deposited by glaciers and their meltwaters, or are thin, eroded residuum (a product of bedrock weathering). Boundaries of these aquifer systems are commonly gradational, and individual aquifers may extend across aquifer system boundaries. The Coal Mine Spoil Aquifer System is man-made and most boundaries are well defined. Except in the northern part of the county, where the thickness of unconsolidated material may exceed 200 feet, the amount of unconsolidated material overlying the bedrock is commonly less than 20 feet. In places, sand and gravel aquifers are located immediately above the bedrock surface. Sand and gravel aquifers occur in the main valley of the White River, East Fork White River, in a deeply buried bedrock valley in northeastern Pike County, and in some smaller buried bedrock valleys that may coincide with present-day valleys.

Regional estimates of aquifer susceptibility to surface contamination can differ considerably from local reality. Variations within geologic environments can cause large variations in susceptibility. Also, man-made structures such as poorly constructed water wells, unplugged or improperly abandoned wells, and open excavations, can provide contaminant pathways that bypass the naturally protective clays.

Dissected Till and Residuum Aquifer System

The Dissected Till and Residuum Aquifer System that covers most of Pike County south of the floodplain of the White and East Fork White Rivers has the most limited ground-water resources of the unconsolidated aquifer systems in the county. Unconsolidated materials of this aquifer system consist of thin, eroded bedrock residuum in most of the county. The residuum has a high clay content and is typically less than 15 feet thick. However, in the northern third of the county the system includes some pre-Wisconsin till, lacustrine silt and clay, and Wisconsin loess. In places, a thin sand layer, commonly less than 5 feet thick, is encountered. Total thickness of the system in Pike County typically ranges from about 5 to 50 feet.

There appears to be little potential for water production in the Dissected Till and Residuum Aquifer System in Pike County. Nearly all wells penetrating this unconsolidated aquifer system in the county are developed in the underlying bedrock. However, in places large-diameter bored (bucket-rig) wells may produce water from thin sands within the predominantly clay and silt materials of this aquifer system. The Dissected Till and Residuum Aquifer System is transected by the Alluvial, Lacustrine, and Backwater Deposits Aquifer System and the Buried Valley Aquifer System. The boundaries between these systems are transitional in many areas of the

county. Clay is abundant in both the till and residuum, thus this aquifer system has a low susceptibility to surface contamination.

White River and Tributaries Outwash Aquifer System

The White River and Tributaries Outwash Aquifer System occupies the valleys of the White River and its major tributaries. However, in Pike County this aquifer is limited to the main valleys of the White River and East Fork White River. These valleys are the only present-day valleys in the county that carried outwash from the melting glaciers far to the north.

The system contains large volumes of sand and gravel that fill the main river valley. As the glaciers melted, the sediment contained within them was delivered to the White River and East Fork White River in quantities too large for the streams to transport. As a result, the increased sediment load was stored in the valleys as vertical and lateral accretionary deposits. As long as the retreating glaciers continued to provide sediment in quantities too large for the stream to transport, the valley continued to be filled. This valley-filling process formed the most prolific aquifer system in the county.

Sand and gravel deposits of this system range from less than 25 feet to more than 90 feet in thickness. This aquifer system, with its thick sand and gravel, contrasts sharply with the adjacent aquifer systems (except the Buried Valley), which show little or no sand or gravel. However, not all of the sand and gravel is saturated with water. Actual saturated aquifer thickness of the White River and Tributaries Outwash Aquifer System ranges from about 25 to 75 feet, but most of the system has an aquifer thickness between 35 and 55 feet. Static water levels typically range from about 10 to 20 feet below land surface. Because water levels are commonly near the base of an overlying fine-grained clay, silt, or muddy sand the aquifer may be under confined or unconfined conditions.

The elevation of the modern East Fork White River floodplain is approximately 435 feet m.s.l. upstream where the river enters Pike County and approximately 415 feet m.s.l. at its confluence with the White River. The floodplain of the White River is approximately 405 feet m.s.l. downstream where it leaves the county. Accurate elevations of the top and bottom of the aquifer itself are hard to determine because there are not many records available for wells completed in the aquifer. However, several records do show about 5 to 30 feet of clay or muddy sand and silt above the aquifer. The bottom elevation of the aquifer is expected to range from about 280 to 310 feet m.s.l. in that part of the valley where the depth to bedrock is greatest.

The White River and Tributaries Outwash Aquifer System is by far the most productive aquifer system in the county and has the potential to consistently meet the needs of high-capacity water users. Well yields of 200 to 1000 gpm can be expected throughout most of the system. Currently there are 5 registered significant ground water withdrawal facilities in the county. This aquifer system is highly susceptible to contamination in areas that lack overlying clay layers. Areas within the system that are overlain by thick layers of clay or silt are moderately susceptible to surface contamination.

White River and Tributaries Outwash Aquifer Subsystem

This aquifer system (subsystem) is generally located adjacent to and parallel to the White River and Tributaries Outwash Aquifer System. It typically occupies a higher topographic position and has considerably thinner sand and gravel units than the main outwash aquifer system. Commonly the sand and gravel is covered by a layer of clay, till, lacustrine, or loess deposits. In places, the upper portions may be unsaturated.

There are no domestic wells or registered significant ground-water withdrawal facilities using this aquifer system in Pike County, therefore no reliable estimates of aquifer thickness or potential yield may be made. In general, this system is highly susceptible to surface contamination. Although the overlying clay or till may provide some protection to the confined portions of the subsystem, in many places surficial valley train deposits coalesce with the deeper outwash deposits making them more vulnerable.

Alluvial, Lacustrine, and Backwater Deposits Aquifer System

The Alluvial, Lacustrine, and Backwater Deposits Aquifer System is composed of unconsolidated deposits in valleys tributary to White River, East Fork White River, and Wabash River. These include deposits in the main valley of Patoka River and South Fork Patoka River. Also included are deposits over two broad areas of northern Pike County. The unconsolidated deposits have two sources. One source is alluvium deposited by a stream along with colluvium eroded from valley walls and uplands. The second source is glaciolacustrine deposits formed in bodies of relatively stagnant lake water, and are marked by soft silt and clay. These lake deposits were formed when the major valleys of the Wabash River, White River, and Ohio River were choked with coarser material carried by glacial meltwater. Thick deposits of this material effectively dammed tributary streams, creating lakes. Thick deposits of silt, sometimes called "slackwater clay," mark the former locations of these glacial lakes. These lacustrine deposits are often noted on Quaternary geology maps and soil maps. They can occur up to an elevation of 520 or 530 feet mean sea level (m.s.l.) in the county.

There are areas in this system where the thickness of unconsolidated materials exceeds 100 feet, for example in the area centered on Mud Creek, adjacent to the Buried Valley Aquifer System and in the valleys of Conger Creek and Little Conger Creek. Very little data are available, but it is expected that wells drilled in these areas may yield sufficient water for domestic needs. Because the Patoka River carried little outwash from melting glaciers, it is doubtful that its main valley has the potential for much more than domestic wells. Well data for many of the smaller alluvial valleys are very sparse. Very little alluvial material is expected in the narrow bedrock-walled valleys.

The overall scarcity of productive zones of sand and gravel in this aquifer system is apparent from the number of water wells completed in the underlying bedrock aquifers. Sand and gravel lenses, where present, are commonly less than 5 feet thick and are confined within the glaciolacustrine deposits, or are directly overlying bedrock. Large-diameter bored (bucket-rig) wells are often employed when other means of extracting seepage from the fine-grained deposits are not available. Wells that penetrate the Alluvial, Lacustrine, and Backwater Deposits Aquifer System commonly have depths that range from 50 to 60 feet, but some may be as shallow as 24

feet. Static water levels in wells penetrating the aquifer system are typically less than 20 feet below the land surface. Yields from domestic wells range from 0 (dry holes) to 30 gpm. Overall, prospects of completing high-capacity wells in this aquifer system are poor. This aquifer system is marked by thick deposits of soft silt and clay that have low susceptibility to surface contamination.

Buried Valley Aquifer System

The Buried Valley Aquifer System consists of aquifer materials deposited in pre-glacial bedrock valleys. During valley development, layers of bedrock were eroded to create valleys that were subsequently filled with unconsolidated glacial sediment of variable thickness. Although there are additional buried bedrock valleys in Pike County, only the larger buried valleys that contain significant water-bearing sediments have been included as mapped units of the Buried Valley Aquifer System.

There is only one main buried bedrock valley located in Pike County. It cuts as deeply as 155 feet into Pennsylvanian (Raccoon Creek Group) bedrock. It enters the county at the eastern county line about one mile southeast of Otwell and trends northwest toward the East Fork White River valley (about 1.5 miles northeast of Algiers). A buried tributary valley trending toward the south-southwest intersects this main trunk about 2 miles west and 1 mile north of Otwell Wells in the Buried Valley Aquifer System are completed at depths ranging from 42 to 187 feet, although well depths ranging from 110 to 160 feet are most common. Static water levels in the wells range from 14 to 50 feet below the ground surface, but static water levels between 15 and 30 feet below ground surface are most common.

Domestic wells typically yield from 10 to 40 gpm. The only high-capacity well completed in this aquifer system has a reported yield of 270 gpm. A major limitation of this aquifer system is the fine-grained, commonly dirty nature of the water-bearing units.

The Buried Valley Aquifer System has a low susceptibility to surface contamination because tills and lacustrine silts and clays generally overlie outwash sediments occurring within the bedrock valleys. Although lenses of outwash sand and gravel may occur within the tills, the predominance of fine-grained sediments above the bedrock valleys limits the migration of contaminants from surface sources to the deep aquifers.

Coal Mine Spoil Aquifer System

The Coal Mine Spoil Aquifer System covers a large percentage (about 24 percent) of Pike County, mostly in the central and southern regions. This aquifer system was formed during the surface-mining process. The overburden, most of which was originally solid rock, was typically broken up by blasting and moved aside to uncover the desired coal seam, thus creating a heterogeneous mixture of particles ranging in size from clay, silt, and sand up to gravel, slabs, and boulders. Where extensive these spoil areas contain considerable amounts of ground water. Although data are lacking on permeability of these spoil materials, it is generally accepted that the spoil permeability is greater than that for most of the original rock layers above the mined coal seam. The quality of ground water in this system is generally much poorer than that in the

overburden before mining took place. Typically a significant increase occurs in total dissolved solids, especially calcium, magnesium, bicarbonate, and sulfate. High iron, and in places low pH, can also severely limit potential uses of ground water from this system. The Division of Water has only 1 record of a water supply well completed in this aquifer system in Pike County. This domestic well yields 20 gpm. A water quality analysis is not available. Very generally, it is expected that aquifers in old spoil that was not graded and capped with compacted soil is highly susceptible to surface contamination, whereas new spoil areas benefiting from modern reclamation methods are likely to be only moderately susceptible.

Registered Significant Ground Water Withdrawal Facilities

Currently there are 5 registered significant ground water withdrawal facilities (total of 20 wells) using unconsolidated aquifers in the county. All facilities utilize the White River and Tributaries Outwash Aquifer System. Reported capacities of these wells range from 120 to 1200 gpm with most between 350 and 1000 gpm. The water is used for 2 public water supplies and 3 energy production facilities. Refer to Table 1 for some details on the wells and to the unconsolidated aquifer systems map for facility locations.

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